ESAVE

Environmental Stewardship & Value Engineering

Quarterly Newsletter for the United States Department of Energy, National Nuclear Security Administration

NIF incorporates P2/E2 in aqueous parts cleaning of optics hardware

Lawrence Livermore National Laboratory's (LLNL) National Ignition Facility (NIF) will be the world's largest laser when completed, with experimental capabilities applicable to stockpile stewardship, energy research, science, and astrophysics. As construction of the building and infrastructure nears completion, parts-cleaning operations supporting installation of the specialized laser equipment have come on-line.

Housed in the Optics Assembly Building (OAB) adjacent to NIF's laser bay are three pieces of aqueous cleaning equipment that play a critical role in the precision cleaning of mechanical parts from the NIF beamline. The optics hardware cleaners were designed with extensive water- and energy-conserving features, and the technology that they use minimizes the hazardous waste associated with solvent wipe cleaning, the traditional method for cleaning laser mechanical components.

The large mechanical parts gross cleaner (LMPGC), the large mechanical parts precision cleaner (LMPPC), and the small mechanical parts gross and precision cleaner (SMPGPC), all designed and built by Sonic Systems, Inc., of Newtown, Pa., accommodate parts that vary greatly in size, weight, geometry, surface finish and material. The cleaned parts must meet stringent NIF cleanliness standards, specifically MIL-STD-1246C Level 83 for particles and A/10 for non-volatile residue.

The LMPGC provides preliminary gross cleaning for large (over 300 kg) mechanical parts. The unit collects, filters, and reuses wash and primary rinse water, limiting its routine discharge to the volume of the low-pressure, deionized, secondary rinse.

Depending on their size, mechanical parts needed for the laser beamline in the National Ignition Facility receive final cleaning in either the small mechanical parts gross and precision cleaner (left) or the large mechanical parts precision cleaner (right). Energy efficiency and pollution prevention were designed into the parts-cleaning operations.

After an initial gross cleaning in the LMPGC, large parts go to the LMPPC, unique because of its size—four 2,700-gallon tanks. Large parts held securely on specialized metal pallets, each of which may weigh up to 1,500 pounds when loaded, move through the tanks on an automated system where operators program all movement, speed, and process times to optimize cleaning.

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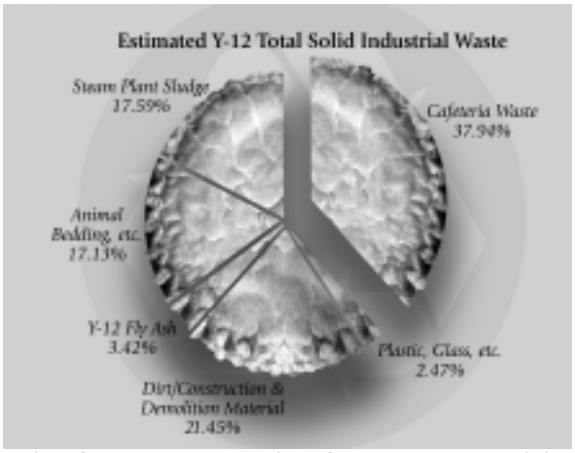
Y-12 Food Services makes leap toward (pollution-)free lunch

It's 5:30 in the morning at the BWXT Y-12 National Security Complex, and a typical day begins in Food Services. Master Chef Leon Partridge is already on the job, preparing food for more than 800 Y-12 workers who will eat here in the main cafeteria or at one of two satellite canteens. By 6:30, a dozen Food Services staff have joined him in the sprawling central kitchen facility, and the pots and pans are rattling.

Around 7:30, the day's supply shipments begin arriving, typically 150 pounds of meat and 365 pounds of fruit and vegetables, plus just-in-time inventoried staples. A Food Services staff member transfers the contents of a vendor's truck to metal pallets and returns the wooden pallets to the driver. As goods are stored, a fellow worker puts cardboard boxes into a baler near the delivery door. Another places empty No. 10 cans in a compactor as their contents go into today's menu, including 175 servings of homemade soup.



Cafeteria waste accounts for a large percentage of the solid industrial waste at Y-12, an alarming fact that may hold true for other DOE facilities.

The aroma of fresh-baked roast beef, yeast rolls, cornbread dressing, and blackberry cobbler mingle and fills the kitchen area, spreading into the dining room as the food is placed on the serving line. Two staffers collect food scraps from the morning's prep line for transfer to the site's composting operation. It's the day

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In the LMPPC cleaning line, an ultrasonic wash tank with automatic feed maintains surfactant concentration and pH. One hundred percent of the wash solution is filtered and reused, so it needs changing only twice a year.

In the pre-rinse spray area, an initial low-volume rinse removes most of the wash solution, maintaining cleanliness in the immersion rinse tank. Effluent from the pre-rinse spray, less than 1 percent of the total volume used in a wash cycle, is the LMPPC's only regular discharge during a normal wash cycle. In the ultrasonic immersion rinse tank, all of the deionized rinse water is filtered and re-polished for reuse, which also saves energy because the rinse water has already been heated. All final spray rinse water is also filtered, repolished, and reused. In the drying area, the hot air is HEPA-filtered and recirculated to conserve energy.

The ultrasonic transducers, spray nozzles, and hot-air nozzles in the LMPPC are mounted on programmable trolleys, measuring approximately one-fifth of a tank's length. The trolleys can be programmed to cover only those areas where a part is present and if needed spend more time on a specific area of a part. This programmability allows effective cleaning, rinsing, drying, and eliminates the need to line the entire wall of a tank with transducers and other fixtures. This design not only adapts the LMPPC to a wide variety of part sizes and configurations but also conserves energy.

The SMPGPC, essentially a scaled-down version of the LMPPC, handles parts weighing up to 300 kg, with a small-parts gross-cleaning system at the front end of the cleaning line and smaller (200-gallon) tanks.

Additional energy-saving features shared by both the LMPPC and SMPGPC include double-walled, insulated tanks to minimize the energy needed to maintain bath temperature, and lids that cover the tanks at all times except when a pallet is being moved from one to another.

Critical mechanical parts used in the NIF receive a preliminary cleaning in the large mechanical parts gross cleaner.

According to OAB Operations Manager Gary Edwards, the LMPPC, in operation for six months, and the SMPGPC, in operation for a year, have functioned exceptionally well. "We have several process development efforts underway to maximize cleaning efficiencies and take advantage of the parts cleaners' features," said Edwards. "This equipment is going to be critical to meeting schedule and throughput requirements for NIF hardware."

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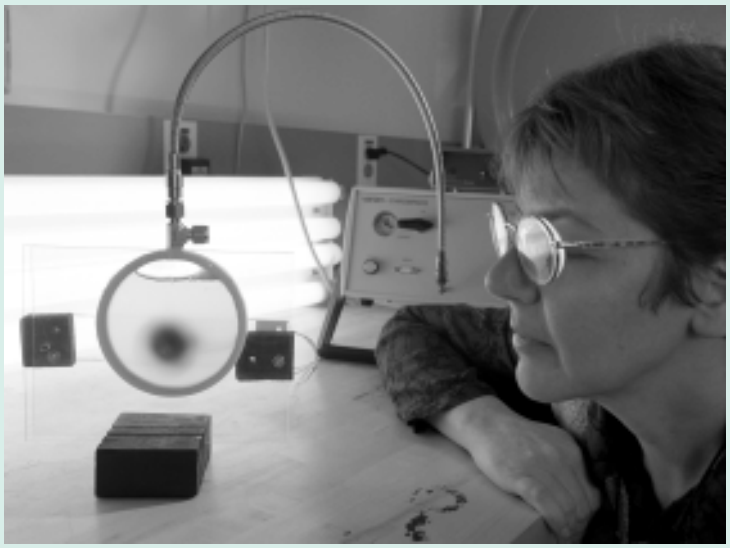
DOE hydrogen-from-algae research offers new fuels for the future



Maria Ghirardi studies a photobioreactor for algal hydrogen production, developed in collaboration with Prof. W. Jacoby of the University of Missouri. A liquid culture of the green alga Chlamydomonas reinhardtii *that has been depleted of sulfate for 30-40 hours is producing hydrogen gas (bubbles at top). With a high degree of purity, the gas stream could be fed directly into a fuel cell for generation of electricity, a potential source of clean, renewable energy.*

Maria Ghirardi of the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) is bioengineering algal hydrogenase to make it more tolerant of oxygen.

Hydrogenase-catalyzed photosynthetic algal hydrogen production from water is a potentially efficient source of clean, renewable energy. However, practical implementation of this system has been hampered in the past due to the extreme sensitivity of the hydrogenase enzyme to oxygen, one of the byproducts of photosynthesis.

With funding for a feasibility study on algal hydrogen production from the DOE Hydrogen Program, Ghirardi expanded the project to include a new process developed jointly by NREL and Lawrence Berkeley National Laboratory. In the DOE project, researchers will complete an initial assessment of the potential of a novel algal H_2-production system.

Ghirardi explains "at this point, not enough hydrogen is produced to make the process commercially viable, but this is one aspect that we are currently addressing in our research." If she succeeds, the more oxygen-tolerant enzyme may be the key to producing commercial quantities of hydrogen which could power fuel cells.

Contact Sarah Holmes Barba, NREL, 303-275-3023 or sarah_barba@nrel.gov

DOE/RL-Hanford teamwork garners two national P2 awards

Cooperation among the Department of Energy's Richland Operations Office (DOE/RL), Hanford Site contractors, and other agencies fostered two DOE National Pollution Prevention (P2) Awards at the June DOE P2 Conference in Albuquerque. The Hanford awards were for "Significant Waste Site Source Reduction Using Small Diameter Geophysical Logging System" and "Implementing a Site-Wide Cultural Change Through Innovative, Cost-Effective and Environmentally Sensitive Approaches."

The Small-Diameter Geophysical Logging System (SDGLS, see *ESAVE*, Second Quarter 2000) collects data on the distribution of subsurface gamma-emitting radionuclides in the unsaturated (vadose) zone of soil at cleanup sites. Supported by the local EPA office, Hanford workers using SDGLS were able to complete remediation of the 100 F Area one year ahead of schedule.

Hanford's other DOE P2 award was for a triage process that focused on sorting and segregating equipment into priority areas, diverting many tons from landfill to reuse and recycle. The two projects were staffed by teams representing Bechtel Hanford, Inc., Bull Run Metal, CH2M Hill, DOE/RL, DynCorp Tri-Cities Services, Inc., Fluor Hanford, Fluor Federal Services, GTS Duratek, Oak Ridge National Laboratory, and Waste Management Technical Services.

Contact Doug Duvon, Bechtel-Hanford, Inc., 509-372-9182 or dkduvon@bhi-erc.com

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to recharge the deep fryer, so the spent oil goes into a barrel for recycling by a local vendor.

By 10:45, the first hungry customers arrive, pick up real silverware and compostable dinnerware, and dig in on freshly prepared pizza, salads, sandwiches, vegetables, and entrees. For a couple of hours, the dining rooms here and around the plant hum with lunchtime conversation. Recycled-wood window shades keep the building and the customers cooler, even in the hot Tennessee Valley summer, while saving energy.

As the late diners return to work around 1:30 p.m., Food Services staff begin their cleanup with environmentally friendly cleaners, substituting baking soda and water for ammonia-based cleaners. Hot rinse water, supplied by on-demand heaters, is double-filtered as it leaves the sinks to cut down on sludge. Three workers package unhandled fresh food for delivery to the Second Harvest food bank. Customers' cornstarch foam dishes and food scraps join the compost from this morning's food prep, which will be mixed with wood chips from the site's tub grinder to form high-grade mulch for the Y-12 grounds.

But the day's not over—there's a late luncheon to be catered for a group of 40 visiting scientists, plus a 7-course dinner for 25, a senior management meeting with representatives from Department of Energy (DOE) headquarters. There's also tomorrow's menu to plan . . .

Y-12 Food Services has moved rapidly toward "green" operations since taking over from an outside management team early in 2001. "Nearly 40 percent of the solid waste produced in this plant was cafeteria waste!" said an incredulous Ron Walton, Area Services Manager and long-time change agent for pollution prevention at Y-12, who oversees Food Service ops. "The things we've done (to change that) are based on plain old common sense."

As an example, Walton said the Y-12 cafeteria uses over 4,200 pounds of tin cans and 10,000 pounds of cooking grease yearly, none of which was being recycled previously. "But that's history," he noted happily. A new can crusher reduces the tin can volume by 6:1, and the compacted cans will be sold as clean scrap. In the past, workers spent at least four hours a day breaking down cardboard boxes "The cardboard baler alone will save over $18,000 a year in labor costs," beamed Walton.

The transition to green operations has been fairly smooth. "The cafeteria has made a complete turnaround. It has become a more enjoyable and pollution-free workplace," said Master Chef Partridge. Food Services workers learn more about environmentally friendly products and methods at the weekly safety meetings, and daily staff meetings are the forum for an informal exchange of tips on the new way of doing things. "We really like the direction we're moving in," says Cafeteria Manager Clysta Johnson, who like Partridge has been with Food Services for two decades. "It's great that we can provide a service for our customers while working to protect our environment."

Food Services Staff at the BWXT Y-12 National Security Complex are happy serving fresh foods prepared with environmental stewardship in mind. (Left to right) Area Services Manager Ron Walton, Cafeteria Manager Clysta Johnson, Master Chef Leon Partridge, cafeteria staff Alma Stevens, David Cornell, Kelly Patterson, Larry Wilson, Gretchen Ooten, Margie Glass, Joyce Dyer, Paul Davis, Peggy Webb, and Janice Lee.

"This (green food services operation) is applicable to all DOE facilities with onsite food service capabilities," added Walton. "We get all these other pollution prevention initiatives going, but the cafeterias get overlooked." Walton encouraged visitors from other DOE organizations and industries to come by the Y-12 cafeteria and "Check it out. This (pollution-free lunch) stuff can be so easy to do!" And, while visiting Y-12, be sure to sample the cornbread dressing. And the roast beef au jus. And the blackberry cobbler. And the apple cobbler. And . . .

Contact Ron Walton, 865-576-8388 or waltonrm@y12.doe.gov

California team develops high-efficiency bi-directional lamp

Researchers at the U.S. Department of Energy's (DOE) Lawrence Berkeley National Laboratory have developed a new high-performance, energy-efficient table lamp that is designed to save energy in homes and offices while greatly increasing lighting quality and visibility.

"Widespread use of this lighting system in offices and homes could greatly reduce the current power problems we have in California while increasing the quality of the lighting environment," says Michael Siminovitch, a scientist in Berkeley Lab's Environmental Energy Technologies Division. "To our knowledge, nothing currently available in the office, hospitality, or residential marketplace has both the high-performance lighting quality characteristics and energy efficiency of this new lamp."

The new lamp uses two independently controllable and fully dimmable compact fluorescent lamps (CFLs), one aimed downward for direct lighting and the other up toward the ceiling, providing high-quality indirect lighting. An optical "septum" separates the two lamps.

The relationships between the lamps, the septum and the lamp shade have been designed to maximize the efficient distribution of light as well as to provide soft and even shade brightness.

Laura McLaughlin powers up a two-lamp fluorescent system developed at Lawrence Berkeley National Laboratory which matches the combined luminous output of a 300-watt halogen lamp and a 150-watt incandescent table lamp while using only a quarter of the energy.

The fully adjustable lights allow users to get the amount of light they need according to the environment and the individual's needs, reducing wasted power and unwanted heat.

Berkeley Lab researchers have partnered with the Sacramento Municipal Utility District, Southern California Edison, and Pacific Gas and Electric to select manufacturers to produce the first 600 prototype table lamps. The utilities will place these lamps in offices, residences and hotels, monitoring energy use and customer satisfaction in an upcoming demonstration program.

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A massive Defense Programs facility under construction at the Savannah River Site is literally founded on fly-ash concrete.

SRS uses fly-ash concrete for major new project at TEF

The Tritium Extraction Facility (TEF) at the Savannah River Site (SRS) is a major new Defense Programs (DP) project supporting stockpile stewardship and national security. One of the first notable events in construction of the TEF took place in May, with a concrete pour of one-half of the base pad for the facility. This pour was the first large-scale use of 50 percent fly-ash concrete at SRS, consisting of 1,840 cubic yards from about 200 mixer trucks over a period of 24 hours. The second half of the TEF base pad was poured in July, with a 1,730-yard fly-ash concrete pour that also took about 24 hours.

Per Executive Order 13101, all Federal agencies are required to purchase products made with recycled or post-consumer content when practical. Concrete with fly-ash is one of the Environmental Protection Agency's (EPA) affirmative procurement-designated products. The fly-ash concrete met technical specifications by providing a final pad with minimal cure cracking which will increase in strength with age, and could be especially good for similar projects that use massive amounts of concrete with no expansion joints. This application of concrete with fly-ash at SRS is a first in large-scale field use of an EPA environmentally preferable product by a DOE-DP facility.

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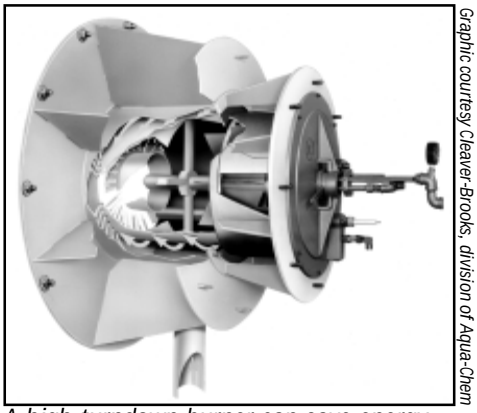
PPPL's high turndown burner saves $$$ and reduces pollution

An oversized boiler operating at reduced capacity during low-load periods causes excessive on/off cycling. Most boiler burners are designed to turn down to a maximum 25 percent of rated capacity; if demand drops below that—to 20 percent, for example—the boiler will cycle on and off, up to 12 times per hour, 288 times per day! As you install energy conservation measures at your DOE facility or enter a low-load period such as the summer months, your boiler may become effectively oversized.

John Clark, chief boiler engineer at Princeton Plasma Physics Laboratory, shows the revised gas "spuds" (short pieces of pipe) in the lab's new high turndown burner. Air is mixed with natural gas at the tips of these spuds for more efficient combustion.

With every on/off cycle, a boiler loses energy from pre- and post-purge airflow and suffers unneeded wear and tear on its motors, controls and fuel-to-air ratio equipment. This results in increased costs for maintenance, component failure, and downtime. On/off cycles also create delays in a boiler's response to surges in demand, since it must go through a specific start-up sequence every time it cycles off, a safety feature that takes one to two minutes and cannot be accelerated.

A high turndown burner addresses all these problems by keeping the boiler on-line during low-load periods, but with a "turndown" in the demand for fuel by a ratio of 10:1 for natural gas and 8:1 for No. 2 fuel oil systems, reducing or eliminating troublesome on/off cycling. It increases efficiency by eliminating purge cycles, reduces component wear and related maintenance as well as the thermal stress caused by on/off cycling, provides a more constant steam pressure or hot water temperature, and virtually assures rapid response to load changes at all times. "From the start-up of the unit at the end of May until the steam system was shut down in early August for maintenance, boiler No. 2 with the high turndown burner did not on/off cycle one time," says Princeton Plasma Physics Laboratory (PPPL) pollution prevention coordinator T.J. McGeachen. "Our (high turndown) burner was manufactured by Cleaver-Brooks, a division of Aqua-Chem, and installed by Miller & Chitty, from Kenilworth, N.J."



Graphic courtesy Cleaver-Brooks, division of Aqua-Chem

A high turndown burner can save energy and costs in boiler operations during periods of lower demand.

The boiler plant operations group of the Maintenance & Operations (M&O) Division at PPPL proposed the high turndown burner concept during the low-load period in summer of FY 2000 when PPPL's boiler was cycling on/off, and oversaw the installation during the winter of FY 2001. PPPL's Environmental Restoration/Waste Management (ER/WM) Division reviewed the concept and performed calculations for fuel savings and emission reduction.

Based on boiler loads during the summer low-load months (June-July) of FY 2000, the ER/WM Division estimated that energy savings from the high turndown burner were approximately 1,500 decatherms per month. Under actual loads, the estimated savings for the same period in FY 2001 was approximately 2,400 decatherms per month. At the current cost of natural gas, this means a fuel cost savings of $18,000 for the June-July 2001 load period. A decatherm is 10 therms (1 therm = 100,000 BTUs), which equates to 1 MCF (1,000 cubic feet) of natural gas usage.

A high turndown burner reduces greenhouse gas emissions, too. For example, in the low-load months of June and July at PPPL, not using 4,800 decatherms of heat energy (burning 4,800,000 cubic feet of natural gas) will eliminate 576,000 pounds of CO_2 emissions, based on AP-42 emissions factors (go to http://www.epa.gov/ttn/chief/index.html).

Retrofit packages for high turndown burners are usually available for field installation on boilers from 250 horsepower and up. PPPL's retrofit installation was completed within three working days, including installation, startup and personnel training. Depending on your boiler size, application, hours of operation, fuel, and current conditions, these savings will vary, but the simple payback period for installation of a high turndown burner should be equal to or less than one year. PPPL's installation has a one-year simple payback period.

Contact T.J. McGeachen, 609-243-2948 or tmcgeach@pppl.gov

ORNL researchers suspect landfills put mercury into environment

The reason for elevated levels of methylmercury in remote lakes in the upper Midwest may be because thousands of landfills around the country are turning inorganic mercury into a far more toxic form of the metal.

As landfill waste decomposes, it generates methane. Scientists at the U.S. Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) suspect that a significant amount of organic, methylated mercury—far more toxic than inorganic mercury—is thus escaping with the untreated methane gas into the atmosphere in the form of dimethylmercury, which may return to ground in rain.

Mercury, a metal that becomes more concentrated as it travels through the food chain, comes from an array of sources, including fluorescent bulbs, pre-1990 batteries, electrical switches, thermometers and construction waste. The ORNL team's findings are to be published in the journal *Atmospheric Environment*, an international journal devoted to air pollution research and its applications.

Contact Steve Lindberg, ORNL, 865-574-7857 or lindbergse@ornl.gov

Central Supply Facility at Argonne-East is a LEED-er in green building

Construction of the Central Supply Facility at Argonne National Laboratory-East was performed to standards set by the U.S. Green Buildings Council in their Leadership in Energy and Environmental Design program.

At Argonne National Laboratory-East (Argonne-East), the new Central Supply Facility (CSF) is making history as one of the first Department of Energy (DOE) structures to pursue certification by the U.S. Green Buildings Council as a Leadership in Energy and Environmental Design (LEED) building. The CSF design won Argonne-East a 2001 White House Closing the Circle Award in the category "Environmental Preferability."

The design-stage request for proposals (RFP) included a clear statement of the project's goals in terms of environmental preferability and gave priority to teams with experience and capabilities for designing LEED-certified buildings. The RFP also specified a building commissioning after construction to verify that the building performs as expected from an energy efficiency standpoint.

"This project presented a variety of opportunities for our in-house staff of architects and engineers to practice what we preach within the LEED framework," said Jack Logue, manager of Argonne-East Facility Engineering and Construction. "We examined the environmentally preferable and energy efficiency savings features with an eye on the target of performance and one on the budget. We made knowledgeable trade-offs and ended up with something we can all be proud of."

The CSF project focused on renovating and expanding an existing building rather than on new construction on undeveloped land. Construction was conducted to reduce site disturbances, manage storm water, and reduce and recycle construction waste.

CSF construction includes numerous environmentally preferable features: fly-ash aggregate in its concrete; recycled concrete block and curbs; reuse of existing gravel, asphalt, sub-base, and excavated soil; recycled structural steel and lumber; sustainable wood products; natural linoleum floors, recycled-content carpeting, ceiling tiles, and gypsum board; recycled-plastic toilet dividers; low-VOC and lead-free paints; and a white roof draining into existing wetlands and native plants.

The building goes well beyond the requirements of Executive Order 13101 for recycled-content construction at Federal facilities, incorporating materials extracted, harvested and manufactured within a 500-mile radius of the construction site, plus renewable and rapidly renewable materials, and low-emission paints and sealants.

Energy-saving features designed and built into the CSF include high-performance windows selective to west and north; clerestory windows and ceiling fans in the high bays; daylight sensors, motion detectors, and timers controlling the high-efficiency ballast lighting inside and out; thermafusers for efficient cooling and ventilation; a variable frequency drive controller on the main air supply fan; high-efficiency pulse-type gas-fed hot water boilers; and waterless urinals.

The CSF's energy performance was modeled using DOE-2 software for making informed decisions about energy efficiency strategies, resulting in optimized glazing, roof and wall insulation, and HVAC systems. The most significant mechanical features in terms of energy performance are the pulse-combustion boiler, automatic temperature controls for air-handling units, variable air volume HVAC system in offices, night setback controls to reduce space heating during unoccupied hours, and lighting and motion sensors in office areas and the warehouse.

Collectively, these measures are estimated to reduce the building's electric energy consumption by 20 percent and natural gas use by 30 percent. This equates to 80,000 kWh per year in electric consumption and 3,000 therms per year in natural gas. Using the pollution coefficients found in DOE's Energy-10 software, these energy-use reductions would reduce greenhouse gas emissions by 55 tons per year.

Already the CSF is being used to develop a reference guide and sustainable design training for Argonne project managers. Because the LEED rating system aims to standardize what constitutes a sustainable building, this project can serve as a case study to other DOE facilities interested in benchmarking their construction projects against the nation's best buildings in terms of sustainability.

According to Ron Ghilardi, CSF construction project manager, the building is currently undergoing a formalized building commissioning and is expected to be in full service later this fall.

Contact Keith Trychta, Argonne-East, 630-252-1476 or ktrychta@anl.gov and go to http://www.usgbc.org and http://gundog.lbl.gov

BDA tools available to assess building energy performance

Energy efficiency design and simulation tools can help architects make better-informed decisions about the energy performance of their designs.

For example, the Building Technologies Department of the U.S. Department of Energy's (DOE) Lawrence Berkeley National Laboratory (LBNL) offers the Building Design Advisor (BDA), which incorporates three functions: the Building Browser for point-and-click selection of building parameters, the Schematic Graphics Editor for input of simplified building models, and the Decision Desktop for comparison of alternative energy performance scenarios.

Go to http://gaia.lbl.gov/bda/index.html

INEEL 'signature' closes the circle on paper waste, security issues

A novel "digital signature" technology for nuclear waste management eliminates paperwork while ensuring electronic integrity of the waste data.

The development by the U.S. Department of Energy's (DOE) Idaho National Engineering and Environmental Laboratory (INEEL) won a 2001 Closing the Circle award, a laurel handed out by the White House in recognition of the best in government environmental programs. The technology also won first place in the "Sowing the Seeds for Change" category in the annual DOE Pollution Prevention awards program.

INEEL's digital signature card, pictured here with Wayne Austad, one of the creators of the patented process, could mean more secure commercial electronic signatures.

TRIPS—Transuranic Reporting, Inventory and Processing System—is an electronic database tool which INEEL uses to manage the shipment of transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP) in New Mexico.

"The TRIPS team is proud that the original vision to reduce the paper-intensive processes needed to ship transuranic waste . . . has been successful," said Barbara Peterson, project manager for TRIPS. "It took the combined talents of many outstanding individuals in database development, process automation and digital signature technology to understand the problem and come up with the solution."

TRIPS makes all but paperless a combination of government regulations, transportation requirements and environmental concerns that up to now had made shipping drums of TRU waste to WIPP a monumental paper producer, as much as 1,000 pages per drum.

Internet users have been electronically "signing" documents for years. What makes the INEEL process unique is the patent-pending technology that allows TRIPS users to simultaneously sign forms throughout the database while maintaining the required security processes.

"Given its large scale, the TRIPS database application is an amazing integration achievement, even without the new digital signature system," said Wayne Austad, TRIPS team member and one of the digital signature creators.

"Using electronic signatures in the process has increased our productivity by at least 50 percent," said Thomas Monk, INEEL project manager for TRU shipments to WIPP.

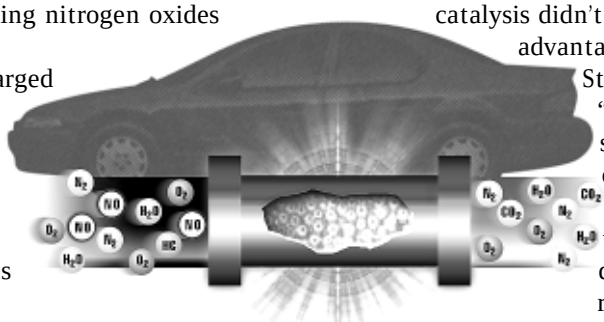
The INEEL researchers are redesigning the program for commercial applications such as Web interfaces for on-line training systems. Not only will the system save natural resources, it will increase the integrity of databases against overt threats or unauthorized changes.

Contact Kathy Gatens, INEEL, 208-526-1058 or kzc@inel.gov

New technology from PNNL reduces noxious diesel emissions

An innovation underway at the U.S. Department of Energy's (DOE) Pacific Northwest National Laboratory (PNNL) may alter the fact that no economically viable technology presently exists to reduce adequately the air pollution-causing nitrogen oxides (NOx) found in typical diesel exhaust.

By experimenting with electrically charged gases—plasma—and a specialized catalyst, PNNL researchers have successfully cut in half harmful oxides of nitrogen emitted by a diesel engine. Laboratory results show even greater reductions—critical to meeting emissions requirements and fuel economy goals in diesel vehicles—are possible.



This diagram demonstrates the novel way that a catalyst developed by PNNL researchers reduces harmful oxides of nitrogen in diesel engine exhaust.

A patent is pending on a class of zeolite catalyst materials that appear to be the key to NOx reduction. Years ago, PNNL scientists showed that plasma, along with a catalyst, could convert nitrogen oxides to nitrogen, a clean component of air. They developed a small reactor to house the plasma reaction and quickly discovered that the packing material used in the reactor affected the chemical reaction.

"Our scientists began looking at various materials and found a specialized catalyst that selectively reduces oxides of nitrogen," said Chuck Peden, principal investigator for the project. Those initial laboratory studies showed that the process reduced NOx by 70 percent.

"Six years ago, this field of non-thermal plasma-activated catalysis didn't exist, but it appears to have many advantages over competing technologies," said Steve Barlow, a PNNL chemical physicist. "For example, our catalysts aren't poisoned by sulfur in the exhaust, which is a challenge for other catalytic technologies.

"Since the beginning, we have worked to improve both the electrical discharge designs and the catalyst performance; the resulting hybrid system is vastly more efficient than what we started out with," Barlow said.

Recent prototype reactor tests conducted on a diesel engine at DOE's Oak Ridge National Laboratory show a 50 percent reduction of NOx. Researchers are continuing to refine the plasma reactor system, which received a patent in 1999, to achieve even greater reduction of NOx. The scientists are working towards a 90-percent reduction in NOx emissions while achieving a fuel economy rating of 80 miles per gallon.

Contact Gayle O'Donahue, PNNL, 509-375-2561 or gayle.odonahue@pnl.gov

Next NNSA P2 workshop sails into San Diego

The National Nuclear Security Administration's 19th Biannual Pollution Prevention Hands-On Training Technology Workshop will be held Jan. 15-17, 2002 in San Diego, Calif. Rapidly emerging as a hub for high-tech companies, The City of San Diego also enjoys a growing reputation for its ambitious pursuit of environmental excellence. This NNSA workshop will provide participants the opportunity to tour the sites and appreciate the efforts of Southern California companies who are fast discovering innovative methods to reduce waste and conserve natural resources through energy efficiency and continual environmental improvement. Workshop attendees will not only hear from nationally known speakers, but will also participate in dynamic discussion groups comprised of their counterparts from sites and labs across the Weapons Complex.

Details about this workshop will be available soon at http://www.dp.doe.gov/dp45/p2/sandiego

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